

DUAL LATERAL SWITCH DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to switches and in particular to dual touch switch devices defining a pair of switches simultaneously closed in response to a single transverse touching force where at least one of the switches has a pressure responsive variable contact resistance.

Switching devices which are operable in response to the application of a transverse touching force are known. Frequently, however, it is desirable to perform several independent switching functions simultaneously upon the application of a single transverse touch force. For example, battery powered musical instruments have recently been developed wherein the keyboards consist of touch sensitive switches interconnected in resistive networks to thereby replace strings or keys utilized on conventional instruments. In such instruments it is desired to be able to generate two tones to form a two note chord by the application of a single transverse touching force. It is also desired to provide a switching device which will allow one of the tones to vary slightly in frequency while the other tone remains of a constant frequency. Such a variation in tone of one note in a dual note chord generates a novel and unusual sound effect in the musical instrument.

The present invention provides a dual switch touch sensitive structure where the dual switches are simultaneously actuated in response to a single touching force. Further, the present invention provides a semiconducting composition over the switch conductors (contacts) of at least one of the switches so that the resistance across the contact of that switch (contact resistance) varies inversely to the amount of force which is transversely applied to close the two switches. Thus, by rapidly increasing and decreasing the transverse force such as by rapidly moving the finger pressing downwardly on the switch, a verbrato or tremolo effect in one tone can be generated without varying the frequency of the tone in the other switch.

SUMMARY OF THE INVENTION

The present invention comprises a tone generating device comprising a switch apparatus defining a pair of switches simultaneously actuated in response to a single transverse force, a first utilization circuit coupled across one of the pair of switches and a second utilization circuit coupled across the other of the pair of switches. The switch apparatus comprises a support member which has a first and second portion or alternatively comprises a pair of support members. A first conductor is then disposed on a first support member portion in a first conductor pattern and a second conductor is disposed on the first support member portion in a second conductor pattern. Similarly, a third conductor is disposed on the second support member portion in a pattern which is the mirror image of the first conductor pattern and a fourth conductor is disposed on the second support member portion in a pattern which is the mirror image of the second conductor pattern. The first and second portions of the support member are folded in one embodiment into a juxtaposed alignment opposite one another in normally spaced relationship with the first and third conductors and the second and fourth conductors transversely aligned in simultaneous actuating proximity. The first and third conductors are thus

transversely movable into electrically conducting relationship and the second and fourth conductors are transversely movable into electrically conducting relationship in response to the application of the single transverse force. Finally, a pressure responsive semiconducting composition is disposed between at least one of the first and third pair of conductors and the second and fourth pair of conductors for providing a contact resistance across either the first and third conductors or across the second and fourth conductors or across both the first and third conductors and the second and fourth conductors. The contact resistance varies inversely to the magnitude of the single transverse force.

The dual switch apparatus may further comprise a spacer surrounding the first, second, third and fourth conductors for maintaining the first and third conductors and the second and fourth conductors in the normally spaced apart relationship.

DETAILED DESCRIPTION OF THE DRAWINGS

A complete understanding of the present invention and of the above and other advantages thereof may be gained from a consideration of the following description of the preferred embodiments taken in conjunction with the accompanying drawings in which:

FIG. 1 is an exploded partial pictorial partial schematic diagram of the present invention in an unfolded, open configuration;

FIG. 2 is a cross sectional side view of the switch apparatus shown in FIG. 1 in the folded operating configuration through section 2—2;

FIG. 3 is an exploded partial pictorial, partial schematic of a second embodiment invention.

DETAILED DESCRIPTION

The present invention comprises a novel switch apparatus which functions generally as a double-pole, single-throw switch whereby two independent switches are simultaneously actuated, that is, closed, in response to a single transverse touch force. In addition, at least one of the switches of the present invention is pressure responsive so that the amount of voltage drop across the switch varies inversely to the amount of touching pressure applied against the switch.

Referring to FIGS. 1 and 2, a pressure actuated dual switch apparatus 10 in accordance with the preferred embodiment of the invention, has a support member 12 which may be made out of a flexible resilient material such as a thin sheet of Mylar. The support member 12 has a first or bottom portion 14 and a second or top portion 16. The first portion 14 and the second portion 16 of the support member are defined by a fold line 18 along which the second portion 16 is folded into an overlaying, but spaced apart, relationship relative to the first portion 14.

A plurality of conductors are then disposed on one side of the support member 12. Specifically, a first conductor 20 electrically interconnected to a first terminal 22 is disposed on the surface of the support member 12 in a first pattern 24 which may be any pattern but is illustrated in FIG. 1 as the U-shaped pattern. A second conductor 30, electrically coupled to a second terminal 32, is disposed on the top of the support member 12 in a second pattern 34 which in FIG. 1 is simply a straight conductor pattern positioned between the legs of the